

Sustainability through Technology M6X02212
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14/5/20

Q2. a)

A typical vehicle at the end of life will be scrapped and sent to a ATF (Authorised Treatment Facility). At the ATF the vehicle will go through the process of depollution whereby components of the vehicle are reused, recycled & recovered.

This is part of the end of life directive where hazardous substances are limited in use, increases the amount of components being recycled in the material filtering back in to the manufacturing process. Lastly the end of life directive encourages reuse, recover and recycle.

The materials recovered in the depollution stage include:-
Fuels, Printed circuits (ECU), lubricants, hydraulics, mercury components, lead components & AC refrigerant. Of these printed circuits contain precious metals, & in conjunction with Lead and mercury components reduce the impact of mining for raw material and reduce the use of hazardous substances as per the ELD (for lead and mercury). Fuels, hydraulics and lubricants can be reprocessed reducing the amount of oil extraction.

(Polyamide)
During depollution plastics and fabrics are ~~removed~~ ^{removed} as these are more recyclable or have limited benefits to recycling, therefore scrapped. This comes as part of preparation to shredding.

Shredding allows for the vehicle to be easily broken down for separation into raw materials and waste. (continued) ①

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Q2) (continued...) After shredding the debris under go a separation process via magnets, Sink-Float and in some cases eddy current. Magnet separation collects all the ferrous metals from the debris which are highly recyclable materials such as steel and iron. Sink-Float is used to separate plastic and other light specific gravity materials from denser materials such as lead, aluminium and other plastics. This Sink-Float process uses in conjunction with magnets separates most desirable materials. Eddy current can be further used to attract non-ferrous metal using eddy current and electro-magnetic fields from left over debris in the process.

This shredding process leaves the desirable steel, aluminium, plastics and in some cases magnesium to be recycled via these own processes, such as EAF (Electric-arc furnace) for steel, which can create new secondary steel from up to 100% scrap, compared to the BOF (Basic oxygen furnace) at 25% scrap.

Aluminium under the Shredding further furnace using a process 20% times more efficient than raw material manufacture.

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(2) b)

The 5 levels of Autonomous vehicles is outlined by the SAE J3016. These define the amount of drive assistant systems taking place within a vehicle and for certain scenarios.

Range from -

- Level 0 - All Human driving (Blind Spot monitors & Front collision detection)
- 1, Driving assistance (Adaptive and Brake control, Cruise control)
 - 2, Partial automation. (Level 1 + Steering control, Adaptive cruise & park assist)
 - 3, Conditional automation (Level 2 + other systems, Roadtrain & Adaptive "BSM")
 - 4, High automation. (Level 3 + Some full system, Valet park & Highway pilot)
 - 5, Full Automation - System operates under all conditions with no driver input (Google car & Robot taxi)

Clearly the Automotive industry sits at a average of level 2-3. Notably Tesla grand unveiling Autopilot technology among other technology has become as statement to the public and manufacturers of what can be achieved.

As the industry progresses further to 3-5 is Autonomous Vehicles different benefits and issues will arise. Firstly the investment has already been seen with Tesla to the gains that can be had with new technology. This will push leading manufacturers away from the ICE with money fueling the development of V alternative drive/purchasing. Further lowering emissions and benefiting the environment. Additional companies are already starting the move to the Autonomous technology such as Atherion, Arrival, LeEco & NextEV, with the addition of Apple Company plans to enter the market.

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Q1b) (continued...)

One of the political issues of the move to more Autonomous Vehicles is the "Real-world" fueling and Security. For many more of a BEV (EV) issue the energy requirements for EVs in the UK far exceeds the energy production for a mass migration from these conventional ICE. Additionally the Security of Vehicles we at first today where keys can be copied and cars can be hacked while on the road.

The various communication networks with a vehicle leave it exposed to hackers and political threats. Advancements in cybersecurity will be required to prevent such events.

Ethical issues are another important consideration for level 5 vehicles as the life of the occupants ("Drive" not closed as driver) is as important as life of pedestrians. These leaves situations where a vehicle could make a choice to save one life or another causing controversy as the situation of programming a system like this is playing percentages. The vehicle does not make the choice ~~they~~ but the manufacturer and the choices trade systems ~~they~~ more could lead to public scrutiny. More machine m.r. also provides a good test of looking at the spectrum of ethical choices of a vehicle such as the value of young, old, rich, poor, gender and species.

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(3) Noise at different circuits has been reduced with many types of success.

The physical changes that can be made to a circuit are columns conditioned and depleted among fans and drivers. These can be adding cones to straight but this can lead to entry especially at circuits with hairpins. Therefore noise can be reduced at road side with fences, earth mounds and facing (noise cancelling panels) - Each have various benefits and drawbacks such as in creating a shelter area or absorbing 10^{-2} . A popular choice is speaker shields where fans can view and hear the vehicles and the noise is deflected from neighbours.

Additionally tracks can impose limits such as time on circuit, max 90 from taking and power limits. This can prevent complaints from neighbours at the time of the race with the ability to prevent nuisance. During the race the vehicles can be limited by noise not monitored on track. Power limits can be imposed and will for not just the engine and exhaust noise but also tyre noise.

ESB) Lion Stirling ASD370

14/5/20.

The Motorsport industry can lead to advancements in various areas of the Automotive Sector. The introduction of electric Vehicle Race Series such as Formula E and Extreme E, can provide transfer technology, noise reduction and public positive opinion.

Using the Hybrid and electric powertrain race series as a reality ground manufacturers can try new technology and improve old systems. For example the Jaguar e-Pace Cup has improved the transmission and energy recovery systems of the new road vehicle from the racing. The battery technology used with Formula E can improve the range of road going vehicles. The Enhanced EV and hybrid platform can operate with hybrids and other areas of power where has not revealed. Formula E has shown public trust motorsport can not only be clean but also sustainable. This improves public opinion of the sport drawing more attention and a broader spectrum of view. There are provided with a noise-free (type noise accounted) experience much more friendly than previous race series.

With 1285 noise public perception around race tracks being noisy sports would be hard hence reducing complaints and leading to a larger neighbourhood community around circuits.